LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

MASTER OF SCIENCE IN

Actuarial Science

MASTER'S FINAL WORK

INTERNSHIP REPORT

Recent Social Security Reforms and its Impact on Old Age Pensions: A Simulation Analysis for Portugal

Gabriela Miriam Kinnunen da Silva

OCTOBER – 2016

LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

MASTER OF SCIENCE IN
Actuarial Science

MASTER'S FINAL WORK

INTERNSHIP REPORT

Recent Social Security Reforms and its Impact on Old Age Pensions: A Simulation Analysis for Portugal

Gabriela Miriam Kinnunen da Silva

Supervisors:
Doutora Maria Teresa Medeiros Garcia
Mestre Carla Sá Pereira

OCTOBER – 2016

Recent Social Security Reforms and its Impact on Old Age Pensions: A Simulation Analysis for Portugal

Abstract

In Portugal, the public old age pension system funding is based on the pay as you go method where workers' contributions pay the pensions of current pensioners. Throughout the years, many changes have been done in the Social Security system legislation, namely regarding retirement pensions. The most recent reform caused an increase in the normal retirement age and added some factors to the calculation of the retirement benefit.

In this report we analyze the impact of those reforms on the old age pension benefit under the Social Security system and on the present value of private pension funds responsibilities. Therefore, we consider the main features of both the public old age pension system and the complementary private pension plans, offered by banks to their employees.

Keywords: normal retirement age; retirement pension; Social Security system; complementary pension plans; DL no. 187/2007; DL no. 167-E/2013

Reformas Recentes na Segurança Social e o Seu Impacto nas Pensões de Velhice: Uma Simulação para Portugal

Resumo

Em Portugal, o financiamento do sistema público de pensões de velhice é baseado no método de repartição em que as contribuições dos trabalhadores pagam as pensões dos atuais reformados. Ao longo dos anos, muitas alterações foram efetuadas na legislação do sistema da Segurança Social, nomeadamente no que se refere às pensões de reforma. Assim sendo, as reformas mais recentes levaram ao aumento da idade normal de reforma e adicionaram alguns fatores ao cálculo do benefício da pensão de reforma.

Neste relatório, iremos analisar o impacto dessas reformas no valor das pensões de reforma no âmbito do sistema de Segurança Social e no valor atual das responsabilidades dos fundos de pensões privados. Assim, iremos considerar as principais características quer do sistema público de pensões quer dos planos de pensões privados complementares, oferecidos pelos bancos aos seus colaboradores.

Palavras-chave: idade normal de reforma; pensão de reforma; Segurança Social; planos de pensões complementares; DL n.º 187/2007; DL n.º 167-E/2013

Acronyms and Abbreviations

ACT: Collective Work Agreement (*Acordo Colectivo de Trabalho*).

ALE: Average life expectancy at age 65. It is published annually by the INE.

DL: Decree-Law.

IAS: Social Support Index (*Indexante dos Apoios Sociais*). The IAS is defined by the Ordinance at vigor that year. At the moment it is equal to 419,22 euros as defined by the Ordinance no. 286-A/2014 at December 31.

INE: Portuguese Statistics Institute (*Instituto Nacional de Estatística*).

NRA: Normal retirement age.

OECD: Organization for Economic Co-operation and Development.

PAYG: Pay as you go.

PBO: Present value of the benefits with past service or projected benefit obligation.

SF: Sustainability factor.

SS: Social Security.

Table of Contents

List of Charts

List of Tables

Preface

This work is the result of a three-month curricular internship done in the actuarial department of Ernst & Young (EY). During this period of time, I had the opportunity to work in non-life insurance and pension funds.

In non-life, I analyzed the data of past claims and the projections of future claims mainly by Chain Ladder and Bootstrap methods.

Since the company needed to study in further detail the theme of the SS pension system and complementary pension plans, the main focus of my work was on that subject. This report is the result of that study.

1. Introduction

The SS system has been a very discussed theme in most of the countries across the world. This discussion is due to the current demographic and economic developments that may not be compatible with the PAYG method, which is the method used to finance most of the SS systems in the world (MacNicol, 2004; Population Reference Bureau, 2009)). Although opinions on the sustainability of the SS system seem to diverge a lot, most of the countries have taken measures to increase the NRA and to change the benefits formulas, in order to make the system more sustainable from the financial point of view[1]. Portugal has been no exception.

In the last 8 years, there have been many changes in the Portuguese SS, although some of them are temporary. The most relevant are:

- **DL no. 187/2007 at May 10** – changed the SS pension benefit and added a SF;
- **DL no. 167-E/2013 at December 31** – changed the NRA, the SF and other factors.

Therefore, it's important to analyze the impact of the most recent reforms in the SS. These reforms impact not only the SS pension, but also complementary pension plans. If the SS legislation is constantly changing, complementary pension funds will have to deal with a high level of uncertainty, as the amount of their responsibilities may suffer a significant increase or decrease, depending on the legislation.

This report will focus on the SS old age retirement pension and the complementary old age pension plans that are associated to it. In order to do so, we will analyze the most recent reform (DL no. 167-E/2013) and its impact on complementary pensions. As one of the most known sponsors of complementary pension plans in Portugal is the banking sector, we will study the impact DL no.167-E/2013 had in the banks responsibilities with old age pensions. All results presented in this document were computed in Excel using Visual Basic for Applications (VBA).

[1] European Parliament (2014) describes some of the recent reforms performed by EU Member States regarding pensions.

2. Complementary pension plans

Pension plans can be qualified in many ways. If we focus on the relationship of the pension plans with the SS, we can divide them as:

1. **SS independent pension plans:** pension plans where the computation of the benefits doesn't depend on the benefit or any parameter of the SS pension;
2. **Complementary pension plans:** pension plans where the benefit depends on the benefit or some parameter of the SS pension.
    - **2.1 Fully integrated with the SS:** the total benefit of the employee (pension of the plan + SS pension) is defined. The pension fund pays the difference between the benefit the employee should receive and the benefit paid by the SS.
    - **2.2 Partially integrated with the SS***:* it is similar to the fully integrated with the only difference that it has an upper limit to the amount the pension plan pays.
    - **2.3 Suppletive pension plans:** other pension plan that depend on the SS pension (i.e., 2 × SS pension).

As referred previously, this report will focus on complementary pension plans, its advantages and disadvantages are summarized in the table below.

Table I: Some advantages and disadvantages of complementary pension plans

	Advantages	Disadvantages
To the employer	Attract employees because it provides them an insurance against the changing of SS legislation;	Transfers the SS risk from the employee to the company; Uncertainty relatively to the amount of contributions the company has to do;
To the employee	Ensure retirement income equity for all employees; The employer covers adverse changes in the SS retirement benefit; The employee knows what benefit he/she will receive when he/she retires;	The employee can't add more contributions if he/she wants; The employee doesn't decide how the money is invested (market risk);

Remark: The description of these kind of pension plans present in Bodie (1990) helped to construct this summary.

3. Portuguese Social Security system

3.1. The current Social Security system

The SS systems are very different from country to country[2] not only in the computation of its pensions but also in its requirements and, most important, in its funding method. There are funded and unfunded SS systems (Plamondon *et al.*, 2002). In Europe most of them are unfunded – their funding method consists in a PAYG basis where workers' contributions are used to pay the pensions of today's retirees. This kind of funding method may not be sustainable because countries, in general, have been confronted with an increasing old-age dependency ratio[3].

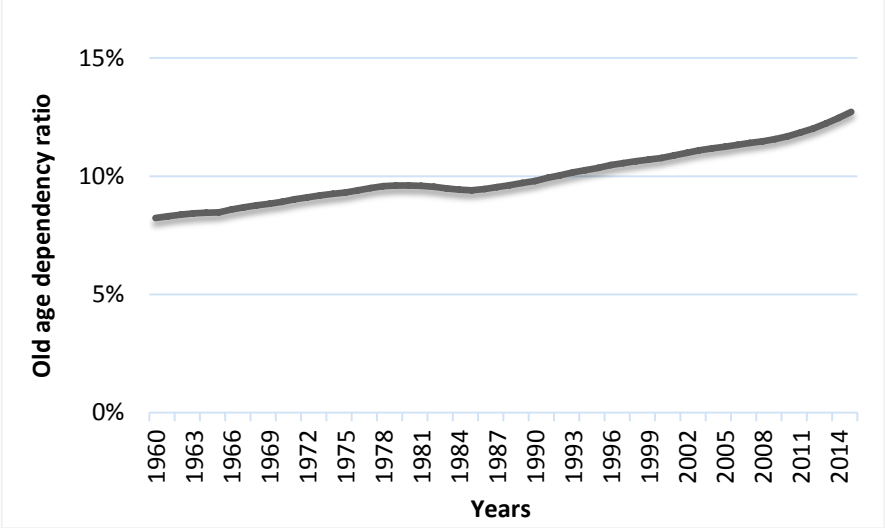

Chart 1: Evolution in the world's old age dependency ratio

Source: World Bank, 2015.

Portugal has a system that is neither completely funded nor completely unfunded. A part of the Portuguese SS is based on a PAYG system but the other is funded based through the creation of the Financial SS Stabilization Fund (*Fundo de Estabilização Financeira da Segurança Social)*, a pension reserve fund. Many countries have adopted this kind of measure due to the high transition costs associated with a change from a PAYG to a SS

[2] See OECD (2015) for a detailed explanation of the SS pensions system for the countries of G20 (G20 includes Argentina, Australia, Brazil, Canada, China, India, Indonesia, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, US and the EU countries).

[3] Usually the old age dependency ratio is computed as $\frac{\text{no. of people aged 65 and over}}{\text{no. of people aged 15-65}}$.

system similar to Chile[4] (Kritzer, 2002), completely funded. In Portugal, the majority of the benefits granted by the SS are still financed by the PAYG system; the Financial SS Stabilization Fund works as a small buffer that can only guarantee the benefits payment during approximately one year (13,78 months according to the last report issued by the Fund at 2014)[5].

The current SS system in Portugal is based in the Social Security Basic Law approved by the Law no. 4/2007 at January 16.

This report will only focus in the old age retirement pension since the others are not included in its scope[6].

3.2. Retirement pension requirements

In Portugal, an individual who decides to retire before the NRA will usually get a reduction in his pension. On the other hand, if the individual retires after the NRA a bonus will be added to his pension. This kind of penalty/bonus system exists to motivate the active population to retire later.

An individual who wishes to retire without any reduction in his SS pension needs to verify two requirements: his retirement age has to be equal or higher than the NRA and he must have 15 years or more of contributions for the SS, as defined by the article no. 19 of the DL no. 187/2007. However, there are four cases, referred below, that are exceptions to these two requirements[7]:

- The flexibility of the retirement age;
- The anticipation of the retirement age caused by the nature of the job;
- Temporary measures for the specific protection of companies or activities by conjectural reasons;
- In the case of long term involuntary unemployment;

[4] In the Chilean model, the PAYG system was replaced by a system where workers contribute to individual retirement savings accounts.
[5] Pursuant to article no. 1 of the *Regulamento de Gestão do Fundo de Estabilização Financeira da Segurança Social,* the goal of the Financial SS Stabilization Fund is to provide enough funds to cover the expectable expenses with pensions, during at least 2 years.
[6] The SS system also provides other kinds of pensions, i.e., disability pensions.
[7] For further details please see article no. 20, DL no 187/2007.

We will only analyze the standard situation of retiring at an age equal or higher to the NRA since the majority of the Portuguese population does so - as can be seen in the OECD (2015).

3.3. Retirement pension

If a beneficiary decides to retire at the NRA – i.e. there is neither penalty nor bonus in the benefit received – the SS pension is computed as follows (please see **Appendix A** in order to get a better understanding of the SS old age pension computation):

- **If a beneficiary is admitted after January 1, 2002:**
  - *And the beneficiary has 20 or less years of contributions:*

    P[8] $= RE \times 2\%\ N$, with $2\%\ N \geq 30\%$
  - *And the beneficiary has more than 20 years of contributions:*

In this case, the formula used to compute the pension will depend of the RE of the beneficiary. In **Table II** computation for each level of RE is presented.

Table II: SS Pension for beneficiaries with more than 20 years of contributions

RE	Monthly Pension received (*P*)
$[0; 1{,}1\ IAS[$	$P = RE \times 2{,}3\% \times N$
$[1{,}1\ IAS; 2\ IAS[$	$P = (1{,}1\ IAS \times 2{,}3\% \times N) + \{(RE - 1{,}1\ IAS) \times 2{,}25\% \times N\}$
$[2\ IAS; 4\ IAS[$	$P = (1{,}1\ IAS \times 2{,}3\% \times N) + (0{,}9\ IAS \times 2{,}25\% \times N) + \{(RE - 2\ IAS) \times 2{,}2\% \times N\}$
$[4\ IAS; 8\ IAS[$	$P = (1{,}1\ IAS \times 2{,}3\% \times N) + (0{,}9\ IAS \times 2{,}25\% \times N) + (2\ IAS \times 2{,}2\% \times N) + \{(RE - 4\ IAS) \times 2{,}1\% \times N\}$
$[8\ IAS; +\infty[$	$P = (1{,}1\ IAS \times 2{,}3\% \times N) + (0{,}9\ IAS \times 2{,}25\% \times N) + (2\ IAS \times 2{,}2\% \times N) + (4\ IAS \times 2{,}1\% \times N) + \{(RE - 8\ IAS) \times 2\% \times N\}$

Source: DL no. 187/2007 at May 10

- **If a beneficiary is admitted until December 31, 2001:**

In the table below we have the summary of the SS pension computation for a beneficiary who is admitted in the SS until December 31, 2001.

[8] P is the SS monthly pension of the beneficiaries admitted after January 1, 2002.

Table III: SS Pension computation

If the beneficiary retires:	
until December 31, 2016:	**after January 1, 2017:**
$P^* = \frac{(P1 \times C1 + P2 \times C2)}{C}$	$P^* = \frac{(P1 \times C3 + P2 \times C4)}{C}$
$C = C1 + C2;$	$C = C3 + C4;$
Exception: If the beneficiary has at least 46 years of contributions he will receive the maximum between this pension (P^*) and the one computed previously (P).	

Source: DL no. 187/2007 at May 10

$P2$ is computed as P.

$P1 = 2\%\, n \times \frac{R}{14 \times N_{15}}$, where $30\% \leq 2\%\, n \leq 80\%$

Exceptions:

Notice that $P1$ has to verify $\boldsymbol{P1 \leq 12 \times IAS}$ (unless $P2 > P1$).

If $P1 > 12 \times IAS$, $P2 > 12 \times IAS$ and $P1 > P2$, then consider $P1 = P2$.

The SS pension is paid monthly and has 14 payments. At July and at December of each year the beneficiary receives the monthly pension plus an equal amount that corresponds to the Vacations and the Christmas subsidy.

4. Recent reforms in the Social Security Pension

As referred before, the evolution of demographic and economic factors has suggested that maybe the SS system needs some changes in its architecture. Having that in mind, the Government has been concerned in trying to revert this situation through changes in the legislation of the SS pensions.

The most important reform is probably the one done by the DL no. 167-E/2013 at December 31 which changes the DL no. 187/2007 at May 10. At the DL no. 167-E/2013 we can identify three main modifications to the previous system:

- The NRA increased;
- The Sustainability Factor (SF) formula changed;
- A bonus factor was added for the computation of the retirement age - for workers with more than 40 years of contributions.

Each of these changes will be explained in further detail.

4.1. Normal retirement age

Until 2013, the NRA in Portugal had remained constant in 65 for a long time, at least since 1949 – as can be observed in OECD (2011). However, it did not remain unchanged in this reform. The NRA changed from the usual 65 to 66 in 2014 and in 2015 in order to adjust it to the change occurred in the SF. However, after 2015 the NRA will change every year, depending on the evolution of the average life expectancy at age 65 (ALE). In the article no. 20 of DL no. 187/2007 including already the changes made by the DL no. 167-E/2013, the new normal age of retirement will be calculated as being the NRA at 2014 (66 years) plus m months where:

$$m_r{}^{9} = \sum_{i=2015}^{r} (ALE_{i-2} - ALE_{i-3}) \times 12 \times \frac{2}{3} \quad (\mathbf{1})$$

[9] Where r is the year of retirement.

Notice that this expression can be simplified:

$$m_r = \sum_{i=2015}^{r}(ALE_{i-2} - ALE_{i-3}) \times \underbrace{12 \times \frac{2}{3}}_{=8} = 8 \times \sum_{i=2015}^{r}(ALE_{i-2} - ALE_{i-3}) =$$

$$= 8 \times [(ALE_{2013} - ALE_{2012}) + (ALE_{2014} - ALE_{2013}) + \cdots + (ALE_{r-3} - ALE_{r-4}) + (ALE_{r-2} - ALE_{r-3})] = 8 \times (ALE_{r-2} - ALE_{2012})$$

and $m = [m_r]$, i.e. m represents the rounded integer part of m_r. So we can say that:

$$NRA = 66 \text{ years and } [8 \times (ALE_{r-2} - ALE_{2012})] \text{ months} \qquad (\mathbf{2})$$

In order to better understand the impact this change will have in the evolution of the NRA, it is necessary to do a projection of the ALE. **Appendix B** shows the projection of ALE and NRA for three different[10]. These models represent an ALE with a constant annual growth, an ALE that depends linearly on the ALE verified on the previous year and a model where the ALE depends linearly on time. Looking at the chart presented below we can see that model 1 and 3 have similar estimates while model 2 gives us a projection with a slower growth of ALE.

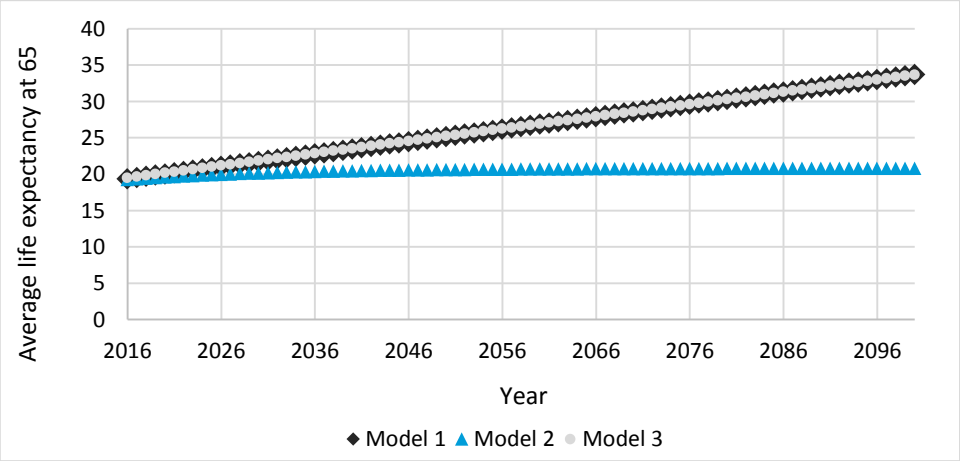

Chart 2: Projection of ALE by the 3 models from 2016 to 2100

In **Chapter 5** we will analyze the impact these projections will have on pensions, for each of the chosen models.

[10] In addition to these three models, we studied the use of a lognormal model and the use of a model who depends linearly of the ALE of the two previous years but rejected these options since the variables were not statistically significant.

4.2. Sustainability factor

The SF is a ratio that reflects the evolution of the ALE; the higher is ALE in the future, the smaller will be SF, so, when it is applied to the pension calculation, the benefit will decrease.

This factor was introduced in Portugal for the first time in 2007 with the DL no. 187/2007. Its main purpose is to reduce or increase the amount of the benefit at retirement in function of the ALE. This way, pensions can be adjusted according with the evolution of the ALE.

The SF, before being changed by the DL no. 167-E/2013, was given by:

$$SF = \frac{ALE_{2006}}{ALE_{r-1}} \quad (\mathbf{3})$$

[11]

With the alteration of the legislation, instead of considering the ALE at year 2006, the SF considers the ALE at year 2000 which has a higher reduction effect than the one used before. Therefore, the SF is:

$$SF = \frac{ALE_{2000}}{ALE_{r-1}} \quad (\mathbf{4})$$

In order to analyze the impact of this reform, we can compute **(4)/(3)** which will give us the ratio $\frac{ALE_{2000}}{ALE_{2006}}$ that is equal to 92,7% and corresponds to a reduction of 7,3%. So, when we apply the new SF, independently of the behavior of the ALE we'll get a reduction effect of 7,3% relatively to the SF obtained with the previous legislation. To illustrate the evolution of the SF from one DL to another we can analyze **Table IV**. In this table the values of SF computed with the formula given by **(3)** and by **(4)** are presented, that correspond to the 2nd and 3rd column of the table. We computed this factor since 2008[12] until 2026. We can observe in **Table IV** that SF suffered a huge decrease along the years (due to the increase of ALE) which also means a higher reduction of the pensions where it is applied.

[11] Where r is the year of retirement.

[12] The SF was first introduced in the DL no. 187/2007 but it was only applied to beneficiaries who retired after January 1, 2008. So 2008 was the first year where the SF was actually used.

Table IV: SF evolution from 2008-2026

Retirement year (r)	SF	
	DL no. 187/2007	DL no. 167/2013
2008	99,34%	92,08%
2009	98,52%	91,32%
2010	98,14%	90,97%
2011	96,50%	89,46%
2012	95,68%	88,69%
2013	95,22%	88,27%
2014	94,57%	87,66%
2015	93,83%	86,98%
2016	93,49%	86,66%
2017	92,67%	85,90%
2018	91,86%	85,15%
2019	91,07%	84,42%
2020	90,29%	83,69%
2021	89,52%	82,98%
2022	88,77%	82,29%
2023	88,03%	81,60%
2024	87,30%	80,92%
2025	86,58%	80,26%
2026	85,88%	79,61%

Remark: Please note that the values stated between year 2008 and 2016 are based on historical values, while the ones from 2017-2026 are computed with the projections from Model 1.

The SF presented in **(4)** is only applicable to people who retire after January 1, 2014; individuals who retired until December 31, 2013, had their pension computed with the previous SF. But the modification done to the formula of the SF was not the only change occurred. In the changes done in the DL no. 187/2007, this SF was created to reduce the pension's value. This new DL decreased the SF having therefore a higher reducing impact but people who retire at the NRA won't have any reduction in their pension caused by this factor. So this factor is only applicable to early retirements.

4.3. Bonus factor

The changes mentioned before have the objective of making the SS system more sustainable from a financial point of view. There are many disagreements, mainly political to the use of this kind of measures since they create dissatisfaction in the active population. Modifications in pensions' computation are usually seen as a sign of financial unsustainability, creating doubts on workers about the benefit they will actually receive at retirement. The 3rd change tries to reduce a little this demotivation from the workers. For the 1st time, a bonus factor is introduced to workers with more than 40 years of contributions[13]. Once a beneficiary makes 65 years and has more than 40 years of contributions his NRA is reduced by 4 months for each extra year above the 40 – being the minimum retirement age 65.

The impact of these changes will be studied in more detail in **Chapter 5**.

[13] Where a year of contribution is as defined in the article no. 12 of the DL no. 187/2007 at May 10.

5. Impact of the reforms

There are many ways to measure the impact of a reform in the SS pensions' computation. We will measure this effect in two ways:

- Comparing the value of the pensions;
- Comparing the present value of benefits (PVB).

In order to do so, we need to choose a funding method to compute the PVB. In this report, we will always use the *Projected Unit Credit* method, since it is the funding method recommended by IAS19[14] for pension funds. Thus, the actuarial liability for active members will be computed as the present value of benefits in respect of past service (PBO), as can be seen below:

$$\boldsymbol{PBO = PVB \times \frac{past\ service}{total\ service}} \qquad (\mathbf{5})$$

This method takes into account expected future salary increases (therefore being called a "Projected" method), it is an accrued benefit method (for more details see McGill *et al.* (2005) or Pugh (2006)).

Notice that in this report we are only focusing in the impact for pensions of employees who retire at the NRA.

5.1. Impact on SS pension – real population

In this chapter, we will examine the impact of the change from the DL no. 187/2007 to the DL no. 167-E/2013 by analyzing the effect it had on the value of the SS pension and on the present value of responsibilities with past service (for the Government). To compute these effects we will use the population presented in **Table C. I** (see **Appendix C**).

[14] IAS19 is one of the rules of the international accounting standards. The IAS19 prescribes the accounting and disclosure standards for employee benefits provided by companies.

As we saw in the previous chapter, many factors changed from DL no. 187/2007 to DL no. 167-E/2013 and therefore each of these factors has to be considered separately. At the end of our analysis we will also verify the effect they have as a whole.

In order to see the impact of the reform we will compare the value of the SS pension computed with the previous legislation (that we will call *Before*) and the SS pensions that have the new changes included (that we will call *After*).

All computations assume that there will be no more changes in the most recent legislation. In order to obtain the values presented in the tables below, we computed the SS pension with the two legislations referred previously. All the results and assumptions used to calculate the SS pension are presented in **Appendix C** and **Appendix D**.

5.1.1. Impact of the change in the NRA

Following the reasoning referred before we will first study the effect of the new NRA. In order to check the impact of the change in the computation of NRA **exclusively**, we have to assume that the values computed as *After* include only the change occurred in the NRA. Our assumptions are detailed in the table below.

Assumptions
Before:
Pensions computed as defined in the DL no. 187/2007: ➢ The NRA is 65 ➢ The SF is applied and computed as **(3)** ➢ There is no bonus factor
After:
➢ The NRA is computed with the formula given in **(2)** defined in DL no. 167-E/2013 ➢ The SF is applied and computed as **(3)** ➢ There is no bonus factor

Nonetheless these assumptions are not enough because the change in the NRA brings up another question: the time value of money (i.e. receiving a pension of 900€ at 2015 or at 2025 isn't the same as there exists inflation and interest). So we have to add one extra assumption: there is an annual discount rate and we will use three different scenarios (an annual discount rate of 0,5%, 2,5% and 4%).

Due to the constant increase of the ALE the use of formula **(2)** to compute the NRA will cause an increase in its value. A rise in the NRA implies that people will retire later, hence the increase will cause two effects:

1. Pensioners will have more years of contributions and possibly higher past salaries which means an increase in the value of the pensions they will receive;
2. Pensioners will receive their pensions later, receiving consequently fewer payments and their pensions will suffer a reduction because of the interest rate effect.

Thus, the value of the pensions will increase or decrease depending of which effect is higher. Analyzing the results for each of the discount rate scenarios (**Table D. I, Table D.II** and **Table D.III** in **Appendix D**), we can conclude that the change in the NRA will either have a positive or negative effect in the pensions depending of the discount rate. For **Scenario 1** the effect referred in point **1** is higher than the effect referred in **2** so we have an increase on the value of the pensions. However, the higher is the discount rate, the higher is its effect. This effect is easy to verify in **Scenario 2** and **Scenario 3**: contrasting with the increase on the value of the pensions verified in **Scenario 1**, in these scenarios we will have a decrease on pensions[15].

The use of an adequate discount rate is therefore very important – since it has direct impact on the conclusions taken. Looking at the discount rates used in 2015 by Banks for pension funds, we can see the rates were around 2,5%[16]. Therefore, in the next results we will use an annual discount rate of 2,5% as it is consistent with the current Portuguese market.

[15] The impact of the discount rate on pensions can be easily analyzed in **Chart 4, Chart 5** and **Chart 6** available in **Appendix D**.

[16] This information can be found in the *Relatórios e Contas* of the companies e.g. in 2015 the annual discount rate was 2,5% for CGD, Santander Totta, Novo Banco, BPI and BCP. In 2013, some Banks used a discount rate of 4%.

5.1.2. Impact of the Sustainability Factor

In this section we will study the impact of the SF **alone** and consequently we have to consider the following assumptions:

Assumptions
Before:
Pensions computed as defined in the DL no. 187/2007: ➢ The NRA is 65 ➢ The SF is applied and computed as **(3)** ➢ There is no bonus factor
After:
➢ The NRA is 65 ➢ The SF is not applied ➢ There is no bonus factor

The pensions computed with these assumptions are presented in the **Table D. IV** (see **Appendix D**). As referred earlier in **Chapter 4**, with the new legislation the SF is no longer applied to the pensions of beneficiaries who retire at the NRA. As our scope only includes pensioners who retire at the NRA, we would expect this change to cause an increase in the pensions, *ceteris paribus*.

Our expectations are fulfilled since we verify and conclude (**Table D. IV** in **Appendix D**) that this change increased a lot the value of the pensions, independently of the model used. Calculating a sample mean, we can conclude that this new change increased the pensions by 12,7%, 9,7% and 13,4% for models 1,2 and 3, respectively.

5.1.3. Impact of the additional bonus factor

Regarding the bonus factor, its impact will not be analyzed separately since the bonus factor can only be applied if we also consider the change of the NRA.

5.1.4. The total impact of the reform

The conclusions taken in the previous sections can be summarized as follows:

1. The increase in the NRA has two effects:

a. It increases the value of the pension as there are more years of contributions;

b. It decreases the value of the pensions because of the interest rate effect.

2. The non-applicability of the SF will increase the value of the pensions;

3. The bonus factor, when applicable, should somehow reduce the effect given by the increase of the NRA.

Analyzing the impact of the reform as a whole, as the discount rates are very low and the effect of not applying the SF is very high this reform should lead to an increase in the value of the pensions (i.e., the effect of **1a** is higher than the effect of **1b**). Nevertheless a decrease on the PBO should be expected as people will retire later (i.e., pensioners will receive fewer payments).

To study the total impact of the new measures we will do the following:

- For the column referred as *Before* we will calculate the SS pension as if the DL no. 187/2007 was still in force;
- For the column referred as *After* we will calculate the SS pension with the new legislation in force (DL no. 167-E/2013);
- We will consider an annual discount rate of 2,5%.

5.1.4.1. The impact in the value of the pensions

Looking at the table presented below, we can conclude that this new measure increased the value of the pensions, as we were expecting.

Table V: Impact of the reform in the value of the SS pensions

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	850,49	982,28	15,5%	885,98	982,28	10,9%	845,19	982,28	16,2%
2	1.018,56	1.128,13	10,8%	1.035,23	1.128,13	9,0%	1.011,43	1.128,13	11,5%
3	991,74	1.123,87	13,3%	1.003,46	1.123,87	12,0%	984,74	1.123,87	14,1%
4	506,21	584,65	15,5%	527,33	584,65	10,9%	503,05	584,65	16,2%
5	456,42	501,19	9,8%	461,81	501,19	8,5%	453,20	501,19	10,6%
6	451,43	508,55	12,7%	463,11	508,55	9,8%	448,32	508,55	13,4%
7	467,26	535,24	14,5%	484,23	535,24	10,5%	464,10	535,24	15,3%
8	526,91	602,83	14,4%	546,04	602,83	10,4%	523,35	602,83	15,2%
9	917,08	1.047,65	14,2%	932,09	1.047,65	12,4%	910,67	1.047,65	15,0%

Remark: Δ is the percentage of increase/decrease occurred from *Before* to *After*. Notice that the values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%. The values are presented in euros.

5.1.4.2. The impact in the present value of the responsibilities with past services

In order to examine the impact of the reforms in the PBO we will need to add the following assumptions:

- Mortality Table: TV88/90;
- *Projected Unit Credit* funding method.

The results obtained in the table below show that the PBO increased instead of decreasing – with exception of beneficiary no. 3 and 9. These unexpected results are due to a very peculiar feature of our population: most of the employees started working at an early age (see **Table C.I** in **Appendix C**) thus when they get to age 65 they have almost 50 years of contributions, which allows them to benefit a lot from the bonus factor. The effect of this feature can be summarized in the following way: with this new reform our population will retire at age 65 or close but with a higher pension[17]. So, we can conclude that in the case of PBO, we have to be careful with the conclusions taken because its value will decrease or increase depending on the characteristics of the population that is being used[18].

[17] To get a better understanding about the differences on the results obtained for each of the DL, please analyze **Table C.II** and **Table C.III** present in **Appendix C**.

[18] Notice also that the reduction or increase of the PBO depends a lot of the discount rate being used – low values of the discount rate may imply that its effect won't be enough to compensate the increase on pensions.

Table VI: Impact of the reform in the PBO

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	78.576,14	90.752,37	15,5%	81.855,08	90.752,37	10,9%	78.086,22	90.752,37	16,2%
2	133.560,99	147.929,59	10,8%	135.747,15	147.929,59	9,0%	132.626,53	147.929,59	11,5%
3	131.634,15	121.718,95	-7,5%	133.189,15	121.718,95	-8,6%	130.705,28	121.718,95	-6,9%
4	45.947,34	51.913,75	13,0%	47.864,70	53.067,39	10,9%	45.660,86	51.913,75	13,7%
5	62.311,20	68.424,22	9,8%	63.047,28	68.424,22	8,5%	61.871,50	68.424,22	10,6%
6	51.399,58	57.903,32	12,7%	52.730,23	57.903,32	9,8%	51.045,97	57.903,32	13,4%
7	45.758,91	52.416,15	14,5%	47.420,36	52.416,15	10,5%	45.449,28	52.416,15	15,3%
8	51.056,63	57.114,77	11,9%	52.910,43	57.114,77	7,9%	50.711,15	57.114,77	12,6%
9	113.577,39	105.992,92	-6,7%	115.436,46	108.516,56	-6,0%	112.782,75	105.992,92	-6,0%

Remark: Δ is the percentage of increase/decrease occurred from *Before* to *After*. Notice that the values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%. The values are presented in euros.

With the purpose of understanding better the effect referred above, we will use our current population and change their date of entrance in the company to a later date (see **Table C.V** in **Appendix C**). The rest of the data will remain equal. In the table below, we have the same impact analysis used in **Table VI** but with the modified data. In **Table VII** we get the results we were expecting: the PBO decreased.

Table VII: Impact of the reform in the PBO (with modified data)

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	73.500,86	71.696,90	-2,5%	76.568,02	70.375,44	-8,1%	73.042,59	71.696,90	-1,8%
2	120.175,37	121.560,70	1,2%	122.142,43	121.560,70	-0,5%	119.334,56	123.637,13	3,6%
3	131.637,72	121.722,35	-7,5%	133.192,76	121.722,35	-8,6%	130.708,83	121.722,35	-6,9%
4	42.129,80	40.860,59	-3,0%	43.887,85	41.153,90	-6,2%	41.867,12	40.860,59	-2,4%
5	59.599,71	56.983,07	-4,4%	60.303,76	56.983,07	-5,5%	59.179,15	56.983,07	-3,7%
6	49.016,95	46.603,62	-4,9%	50.285,92	46.603,62	-7,3%	48.679,73	46.603,62	-4,3%
7	41.661,64	40.703,95	-2,3%	43.174,32	41.744,72	-3,3%	41.379,73	40.703,95	-1,6%
8	46.437,21	46.746,39	0,7%	48.123,28	45.942,56	-4,5%	46.122,99	45.606,23	-1,1%
9	97.081,30	94.425,67	-2,7%	98.670,35	97.048,61	-1,6%	96.402,07	94.425,67	-2,1%

Remark: Δ is the percentage of increase/decrease occurred from *Before* to *After*. Notice that the values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%. The values are presented in euros.

Analyzing the age groups of the Portuguese population in recent years we can verify that few people start working before the age of 25. According to data published by INE, in 2015 only 7,11% of the active population was between 15 and 24 - so only a small percentage of workers will benefit from the bonus factor. Therefore, having into account

the current active population, further analysis is needed since our data set is not an adequate sample of the Portuguese population.

5.2. Impact on SS pension - standard population

Having in account the characteristics of our population[19], we can conclude that the results which apply to this particular set of beneficiaries don't extend to the general population. Therefore we decided to evaluate the impact of the changes in a standard population. In order to perform that analysis we considered the following data:

Table VIII – Average monthly net income in Portugal, by age group

Age	Monthly wage
From 15 to 24 years old	533
From 25 to 34 years old	725
From 35 to 44 years old	868
From 45 to 64 years old	906
With 65 years old or older	715

Source: INE, *Inquérito ao Emprego*

Based on this data we created five different scenarios for beneficiaries who are 20, 30, 40, 50 and 60 years old. With exception of one beneficiary who is 20 years old, we considered that this standard sample started working at an age between 24 and 27[20].

Table IX: Standard population based on INE's information

Scenario	Date of birth	Entry date	Current Age	Age of entry	Monthly Wage (euros)
1	19/04/1995	02/06/2015	20	20	533
2	23/01/1985	17/08/2010	30	25	725
	06/07/1985	28/09/2011	30	26	725
	03/02/1985	16/07/2012	30	27	725
3	14/04/1975	17/12/2000	40	25	868
	30/06/1975	29/11/2001	40	26	868
	28/04/1975	28/12/2002	40	27	868
4	14/08/1965	04/06/1990	50	24	906
	19/02/1965	15/01/1991	50	25	906
	16/09/1965	16/06/1992	50	26	906
5	29/09/1955	11/06/1980	60	24	906
	27/03/1955	04/12/1981	60	26	906
	20/05/1955	04/10/1982	60	27	906

[19] The population analyzed has already an advanced age and has many years of contributions to the SS, these features do not represent the majority of the active population in Portugal .
[20] Which represents 92,89% of the active population in Portugal, as referred in **Chapter 5.1.**

To this part of the report it is important to refer that for our previous population we had small differences between the results obtained for each model (**Table V** and **Table VI**), in this analysis we will see higher deviances in the results between the models. This is due to the advanced age of our population and because the projections of ALE for the first years, for each model, do not differ a lot. If we analyze **Chart 2**, it's easy to conclude that although the three models start the projections with similar values, afterwards there is a big drift between model 2 and model 1 and 3. These differences will be reflected in our results[21].

Table X: Impact of the reform on the value of pensions for a standard population

Scenario	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	557,19	809,01	45,2%	718,10	826,65	15,1%	555,90	809,01	45,5%
2	662,74	896,11	35,2%	803,06	908,96	13,2%	660,60	894,34	35,4%
	651,28	896,11	37,6%	789,17	908,73	15,2%	649,17	894,12	37,7%
	639,69	896,11	40,1%	775,12	908,96	17,3%	637,62	894,34	40,3%
3	691,84	892,38	29,0%	787,56	901,15	14,4%	688,88	892,38	29,5%
	689,32	889,14	29,0%	784,69	897,86	14,4%	686,37	889,14	29,5%
	677,03	889,14	31,3%	770,69	897,86	16,5%	674,13	889,14	31,9%
4	683,12	807,61	18,2%	731,95	813,22	11,1%	679,37	805,82	18,6%
	667,72	790,80	18,4%	715,46	796,48	11,3%	664,06	803,90	21,1%
	652,44	803,67	23,2%	699,09	809,24	15,8%	648,86	801,88	23,6%
5	638,08	699,95	9,7%	648,62	702,72	8,3%	633,68	698,40	10,2%
	608,18	686,07	12,8%	618,22	688,79	11,4%	603,98	684,72	13,4%
	606,71	681,55	12,3%	616,73	672,71	9,1%	602,52	688,03	14,2%

Remark: Δ is the percentage of increase/decrease occurred from *Before* to *After*. Notice that the values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%. The values are presented in euros.

Regarding the value of pensions, we can conclude that recent changes done by DL no. 167-E/2013 resulted in higher pensions. Moreover, this increase is higher to people at younger ages (**Table X**). This behavior can be partially explained by the evolution of the NRA for each of these scenarios. Evaluating **Table XI**, we can conclude that younger beneficiaries will have to work more years in order to achieve the NRA. This will result in higher wages at the last years since we assume their salary will increase 2% every year.

[21] All results will be computed with the same assumptions used in the previous chapter, namely:

- Discount rate of 2,5%;
- Mortality Table TV88/90;
- Projected Unit Credit funding method.

Table XI: Retirement age according to DL no. 167-E/2013 for a standard population

Scenario	Model 1			Model 2			Model 3		
	Retirement date	Retirement age		Retirement date	Retirement age		Retirement date	Retirement age	
		Years	Months		Years	Months		Years	Months
1	19/03/2065	69	11	19/03/2061	65	11	19/03/2065	69	11
2	23/02/2055	70	1	23/03/2052	67	2	23/03/2055	70	2
	06/08/2055	70	1	06/09/2052	67	2	06/09/2055	70	2
	03/03/2055	70	1	03/04/2052	67	2	03/04/2055	70	2
3	14/04/2044	69	0	14/05/2042	67	1	14/04/2044	69	0
	30/06/2044	69	0	30/07/2042	67	1	30/06/2044	69	0
	28/04/2044	69	0	28/05/2042	67	1	28/04/2044	69	0
4	14/06/2033	67	10	14/06/2032	66	10	14/07/2033	67	11
	19/12/2032	67	10	19/12/2031	66	10	19/01/2033	67	11
	16/07/2033	67	10	16/07/2032	66	10	16/08/2033	67	11
5	29/05/2022	66	8	29/03/2022	66	6	29/06/2022	66	9
	27/11/2021	66	8	27/09/2021	66	6	27/12/2021	66	9
	20/01/2022	66	8	20/11/2021	66	6	20/02/2022	66	9

In addition to this fact we also have to consider the impact of the SF on pensions computed by the DL no. 187/2007 (present in column *Before*). Through **Table XI**, it is possible to conclude that younger beneficiaries will have a lower SF when they retire at 65, which means receiving a lower pension when compared with the one received by older beneficiaries (e.g., in model 3 an individual who is now 20 years old will only receive 66,62% of his pension while a beneficiary who is 50 years old will receive 82,03%).

Table XII: Sustainability Factor for each scenario

Scenario	Model 1	Model 2	Model 3
1	66,84%	86,54%	66,62%
2	71,36%	86,96%	71,08%
3	76,54%	87,64%	76,18%
4	82,52%	88,90%	82,03%
5	89,52%	91,39%	88,90%

To sum up, with this new DL younger people will have higher increases on their pensions' value due to two situations:

1. They will retire later and therefore will have higher wages to be considered in the computation of their pension;
2. Their pension computed with the previous DL has a high reduction due to the SF.

Table XIII: Impact of the reform in the PBO for a standard population

Scenario	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	457,26	474,65	3,8%	589,31	639,75	8,6%	456,20	474,65	4,0%
2	7.490,64	7.075,48	-5,5%	9.076,60	8.873,91	-2,2%	7.466,42	7.017,68	-6,0%
	5.743,41	5.472,11	-4,7%	6.959,43	6.897,26	-0,9%	5.724,84	5.424,83	-5,2%
	4.861,51	4.726,11	-2,8%	5.890,81	5.948,63	1,0%	4.845,79	4.686,05	-3,3%
3	27.884,57	27.175,09	-2,5%	31.742,32	31.510,82	-0,7%	27.765,23	27.175,09	-2,1%
	26.237,26	25.481,55	-2,9%	29.867,11	29.595,05	-0,9%	26.124,97	25.481,55	-2,5%
	24.864,35	24.551,27	-1,3%	28.304,26	28.531,11	0,8%	24.757,93	24.551,27	-0,8%
4	58.436,70	56.782,71	-2,8%	62.614,20	61.382,68	-2,0%	58.115,92	56.327,28	-3,1%
	59.223,99	57.732,92	-2,5%	63.457,77	62.386,95	-1,7%	58.898,90	58.353,91	-0,9%
	53.683,64	54.141,51	0,9%	57.521,35	58.606,11	1,9%	53.388,95	53.696,81	0,6%
5	100.215,70	98.120,45	-2,1%	101.870,37	99.668,79	-2,2%	99.523,94	97.347,72	-2,2%
	99.530,21	100.189,06	0,7%	101.173,57	101.789,26	0,6%	98.843,19	99.397,36	0,6%
	97.558,22	97.649,30	0,1%	99.169,02	97.537,72	-1,6%	96.884,81	98.018,42	1,2%
Total	**566.187,44**	**559.572,21**	**-1,2%**	**598.236,12**	**593.368,04**	**-0,8%**	**562.797,10**	**557.952,62**	**-0,9%**

Remark: Δ is the percentage of increase/decrease occurred from *Before* to *After*. Notice that the values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%. The values are presented in euros.

Regarding the impact on the present value of responsibilities, in **Scenario 1** we can see the case of a beneficiary who is part of the small group of people who start working at an early age and who benefit from the bonus factor. This results in an increase of PBO for any of the three models. However this result does not extend to all scenarios. For people who start working after 24, in general the PBO has decreased, with the younger age groups being the ones to suffer a higher reduction.

In conclusion, it is expected that this new reform causes an increase in the value of pensions and a decrease in the PBO for the population in general, with a higher impact on younger people.

5.3. Banking sector

5.3.1. Complementary pension plan

In general, banks are ruled by a unique and common ACT. The ACT is an agreement between one or more companies and the respective union that establishes the working conditions that will be applied to the workers. We will focus in the retirement pensions defined in this ACT as they are complementary pensions.

The most recent change in the banking sector ACT was done in 2012. At the moment, the updated ACT is the one published in the *Boletim do Trabalho e Emprego* no. 8 at February 29, 2012[22].

With the recent changes done to the ACT banks have currently two types of plans:

- **For the employees admitted before January 1, 2008**: a defined benefit plan;
- **For employees admitted after January 1, 2008:** a defined contribution plan.

Since the purpose of this work is to explore the complementary pension plans we will only focus on the defined benefit plan offered to employees admitted before January 1, 2008 and who are covered by the SS[23]. The retirement pension benefit is computed as:

$$B = \left(x\% \times B_{wage} + B_{senior}\right) - B_{SS} \quad (\mathbf{6})$$

B monthly benefit paid by the bank.

$x\%$ percentage in function of the total service time in the banking sector. It's given in the Annex V of the ACT;

B_{wage} monthly benefit obtained in function of the level of salary of the employee. Its value is fixed in the Annex VI of the ACT;

[22] *Boletim do Trabalho e Emprego* is a document published weekly that contains information about the working regulations, statutes and other relevant information for the working environment.
[23] The banking work force was only included in the SS system through the DL no. 1-A/2011 at January 3rd. In addition, notice that complementary pension plans represent a small percentage of the defined benefit pension plans offered in Portugal (approximately 30,2%, according to statistics of ASF in 2015). Moreover, pension plans which are integrated with the SS as the one offered by the banking sector, represent only around 25,4% of the total number of defined benefit pension plans.

B_{senior} monthly benefit obtained in function of the tenure bonus (*diuturnidade*) given to the employee at the year before retirement. It's computed as explained in the clause no. 105 of the ACT;

B_{SS} monthly benefit paid by the SS.

The NRA to acquire this pension is 65 years, which means banks have to support the cost of this pension all by themselves until the NRA defined for the SS.

Pursuant to the classification presented in **Chapter 2**, this is a pension plan fully integrated with the SS.

5.3.2. Impact of the reform on complementary pensions - example

The impacts observed in the previous subchapter show that in general this new reform increased the value of pensions and decreased the PBO. In addition, since the SS pension is only received later, this implies banks will have to pay 100% of their employees' pensions from 65 until the correspondent NRA. We will now analyze what is the impact of these measures on the banking sector responsibility for an hypothetical population of 5 individuals[24].

Table XIV: Impact of the reform in the PBO of banks

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	4.323,15	3.328,13	-23%	2.301,39	1.833,46	-20%	4.352,06	3.328,13	-24%
2	10.173,25	6.707,97	-34%	6.508,27	4.620,59	-29%	10.222,36	6.808,65	-33%
3	94.609,65	85.038,77	-10%	85.045,40	80.787,74	-5%	95.537,68	85.796,10	-10%
4	71.010,75	63.200,77	-11%	65.106,36	60.435,18	-7%	71.417,75	63.606,70	-11%
5	117.437,52	103.604,41	-12%	113.224,72	102.558,44	-9%	118.164,64	104.111,14	-12%

Remark: Δ is the percentage of increase/decrease occurred from *Before* to *After*. Notice that the values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%. The values are presented in euros.

Looking at the table above we can see that the change that occurred in the SS pension resulted on a decrease in banks' responsibilities regarding this population. This is due to the high increase in the value of the SS pensions offered by the State. However, the increase of the NRA causes a big pressure for banks on the first years of retirement. In order to see

[24] These results are only applicable to the specific population used which has some particular characteristics in order to simplify the computations (e.g., many years of service in the banking sector). Since there is no data about the banking sector this impact can't be extended to the banking population in general.

this effect let's consider $B(2007)_t$ and $B(2013)_t$ the annual pension on year t which is responsibility of the bank according to DL no. 187/2007 and DL no. 167-E/2013, respectively. If we consider as negative cash flows $tp_x \times B(2007)_t$ and as positive cash flows the ones given by $tp_x \times B(2013)_t$, where tp_x represents the probability of a person x years old surviving until age $x + t$, then we can compute the discounted payback period as being the minimum t for which:

$$\sum_{t \geq 0} tp_x \times (1{,}25)^{-t} \times (B(2013)_t - B(2007)_t) > 0 \qquad (7)$$

The discounted payback period will provide us information on how many years does it take until the responsibilities of the bank with the new legislation decrease when compared with the previous one.

Table XV: Discounted payback period for each model

No.	Model 1	Model 2	Model 3
1	20,00	18,00	20,00
2	12,00	6,00	12,00
3	20,00	26,00	20,00
4	18,00	19,00	19,00
5	9,00	7,00	9,00

It is possible to see that, for this population, the impact of the change in the SS legislation is negative for a considerable amount of years (e.g., 26 years for beneficiary 3 in model 2). It is probable that this effect will be higher for younger beneficiaries because the NRA will be higher, i.e. the number of years for which the bank will have to pay the pension by itself will be larger.

6. Conclusions

In this report, we analyzed the impacts of the change on the legislation regarding the SS old age pension to workers who retire at the NRA. Our study focused on two main impacts: the effect on pensions given by SS and the effect on complementary pensions offered by banks, according to the ACT.

The results were obtained through the use of Excel and Visual Basic for Applications which are useful tools, easy to work on. Nevertheless, our data set was relatively small and a larger data set could have demanded the use of statistical software.

First, we analyzed the effect of each of the changes done in DL no. 167-E/2013 individually. Then, we studied the effect of the reform as a whole on the pensions value and on PBO. Results showed us that for a regular Portuguese worker, who starts to work at age 25 or later, the pensions increased in value but Government's responsibilities with retirement pensions decreased.

In general, this reform allowed a reduction on the Government's responsibilities due to the effect of increasing the NRA. However, this rise of the NRA has negative effects which are not taken into account in the computations. Looking at **Table B.I** in **Appendix B**, according to **Model 1**, the NRA in Portugal at 2040 will be 68 years and 10 months, opposing to the 65 years at 2013. This evolution on the NRA is caused by higher average life expectancies. A higher average life expectancy means people will live longer, but living longer isn't equivalent to being able to work longer. If a person lives in average until 100 years old it is highly unlikely that the individual is healthy enough – both physically and mentally – to work until 70 or 80 years.

I agree with the argument that SS systems in general, Portugal in particular, need to be restructured, but increasing the NRA isn't the "magic solution" and governments have had a big disregard for workers by assuming they can work at such late ages.

Regarding the particular case of complementary pensions offered by banks, the new legislation had impact on its computation, namely because employees retire at 65 years,

which means banks have to support the cost of this pension all by themselves until the NRA defined for the SS.

All computations were performed with data sets of small dimension and therefore are not a representative sample, larger data sets would have been preferable to take conclusions. Additionally, it was not possible to get real data to compute the banking pension, hence the conclusions taken do not apply to the banking sector in general.

In addition, it would have been interesting to also analyze the impact on other complementary pension plans, for instance on complementary pension plans offered by the insurance sector.

7. References

Bodie, Z. (1990), Pensions as Retirement Income Insurance, Journal of Economic Literature, Vol. XXVIII (March), pp. 28-49.

Boletim do Trabalho e Emprego, N.º 3 (2011), de 22 de janeiro, Acordo Colectivo de Trabalho entre várias instituições de crédito e a FEBASE. Available from: http://bte.gep.msess.gov.pt/completos/2011/bte3_2011.pdf [Accessed 27 September 2015].

Boletim do Trabalho e Emprego, N.º 8 (2012), de 29 de fevereiro, Acordo Colectivo de Trabalho entre várias instituições de crédito e a FEBASE. Available from: http://bte.gep.msess.gov.pt/completos/2012/bte8_2012.pdf [Accessed 27 September 2015].

Diário da República, 1.ª série — N.º 11 (2007), Law no. 4/2007, at January 16. Available from: [Accessed 27 September 2015].

Diário da República, 1.ª série — N.º 90 (2007), Decree-Law no. 187/2007, at May 10. Available from: https://dre.pt/application/file/520704 [Accessed 27 September 2015].

Diário da República, 1.ª série — N.º 253 (2013), Decree-Law no. 167-E/2013, at December 31. Available from: https://dre.pt/application/file/164489 [Accessed 27 September 2015].

Diário da República, 1.ª série — N.º 243 (2014), Ordinance no.266/2014, at December 17. Available from: https://dre.pt/application/file/65891202 [Accessed 27 September 2015].

Diário da República, 1.ª série — N.º 252 (2014), Ordinance no. 286-A/2014, at December 31. Available from: https://dre.pt/application/file/66014835 [Accessed 27 September 2015].

European Parliament (2014). Pension Schemes, Study for the EMPL Committee.

Instituto de Gestão de FunFrom (2014), Regulamento de Gestão do Fundo de Estabilização Financeira da Segurança Social 2014

Kritzer, B. (2002). Social Security Reform in Central and Eastern Europe: Variations on a Latin American Theme, *Social Security Bulletin*, 64 (4). [Online] Available from: *Social Security Office of Policy*. https://www.ssa.gov/policy/docs/ssb/v64n4/v64n4p16.html [Accessed 1 August 2015].

MacNicol, R. (2004). Pension: Finance, Risk and Accounting. In *Encyclopedia of Actuarial Science.* John Willey & Sons, Ltd.

McGill, D. M., Brown, K. N., Haley, J. J., Schieber, S., & Warshawsky, M. J. (2005). *Fundamentals of private pensions* (2005). New York, US: Oxford University Press, Inc.

OECD (2011). *Pensions at a Glance 2011: Retirement-income Systems in OECD and G20 Countries*, OECD Publishing. http://dx.doi.org/10.1787/pension_glance-2011-en

OECD. (2015). *Pensions at a Glance 2015: OECD and G20 indicators.* OECD Publishing. http://dx.doi.org/10.1787/pension_glance-2015-en

Plamondon, P., Drouin, A., Binet, G., Cichon, M., McGillivray, W. R., Bédard, M., & Perez-Montas, H. (2002). *Actuarial Practice in Social Security.* Geneva: International Labour Office.

Population Reference Bureau (2009). Social Security Systems Around the World, *Today's Research on Aging,* (15) [Online] Available from: *Population Reference Bureau*. http://www.prb.org/pdf09/TodaysResearchAging15.pdf [Accessed 1 August 2015]

Pugh, C. (2006). *Funding Rules and Actuarial methods.* OECD Publishing.

Appendix A: Social Security old age pension variables

$\boldsymbol{N}$: Total number of years with contributions relevant, maximum of 40.

$\boldsymbol{R}$: Total of the 10 best wages in the last 15 years with contributions (or if there is less than 10, the total wages registered in the last 15 years).

$\boldsymbol{N_{15}}$: Total number of years with contributions in the last 15 years, with the maximum of 10.

$\boldsymbol{n}$: Total number of years with contributions.

$\boldsymbol{RE}$: Reference earnings; where:

$$RE = \frac{TE}{14 \times N}$$

$\boldsymbol{TE}$: Total earnings (wages) of all the years with contributions, with the maximum of 40 years – if the beneficiary has more than 40 consider the best 40 wages. Notice that these wages should be revalued. The wages referring to periods previous to January 1, 2002 should be revalued using the IPC excluding housing (available in the Annex I of the Ordinance no.266/2014). The wages referring to posterior years should be revalued as the ones referred before unless the following formula allows the beneficiary to have a higher benefit:

$$75\% \times IPC_{excluding\ housing} + 25\% \times \text{average evolution of the contributions to the SS}$$

(Available in the Annex II of the Ordinance no.266/2014).

Where this formula is limited to a maximum equal to $IPC_{excluding\ housing} + 0{,}5\%$.

$\boldsymbol{C1}$: Number of years with contributions of relevant wages until December 31, 2006.

$\boldsymbol{C2}$: Number of years with contributions with relevant wages after January 1, 2007.

$\boldsymbol{C3}$: Number of years with contributions with relevant wages until December 31, 2001.

$\boldsymbol{C4}$: Number of years with contributions with relevant wages after January 1, 2002.

Remark: Note that the number of years is computed in accordance with the definition given in the article no. 12 of the DL no. 187/2007.

Appendix B: ALE and NRA projections

Model 1: $\widehat{ALE}_t = \widehat{ALE}_{t-1} + 0,170667$

Assumptions	
ALE annual growth	0,170667

Remark: the annual growth considered was computed as the average annual growth of the ALE from the year 2000 until the year 2015. For this computation INE tables were used to obtain the ALE.

Table B. I: Projection of ALE and the retirement age for 2016-2040 (Model 1)

Year (r)	ALE	m_r	m	NRA
2016	19,36	2,24	2	66 years and 2 months
2017	19,53	2,8	3	66 years and 3 months
2018	19,7	4,16	4	66 years and 4 months
2019	19,87	5,52	6	66 years and 6 months
2020	20,04	6,88	7	66 years and 7 months
2021	20,21	8,24	8	66 years and 8 months
2022	20,38	9,6	10	66 years and 10 months
2023	20,55	10,96	11	66 years and 11 months
2024	20,72	12,32	12	67 years
2025	20,89	13,68	14	67 years and 2 months
2026	21,06	15,04	15	67 years and 3 months
2027	21,23	16,4	16	67 years and 4 months
2028	21,4	17,76	18	67 years and 6 months
2029	21,57	19,12	19	67 years and 7 months
2030	21,74	20,48	20	67 years and 8 months
2031	21,91	21,84	22	67 years and 10 months
2032	22,08	23,2	23	67 years and 11 months
2033	22,25	24,56	25	68 years and 1 month
2034	22,42	25,92	26	68 years and 2 months
2035	22,59	27,28	27	68 years and 3 months
2036	22,76	28,64	29	68 years and 5 months
2037	22,93	30	30	68 years and 6 months
2038	23,1	31,36	31	68 years and 7 months
2039	23,27	32,72	33	68 years and 9 months
2040	23,44	34,08	34	68 years and 10 months

Model 2: $\widehat{\boldsymbol{ALE}_t} = \mathbf{1,2571} + \mathbf{0,9396}\ \widehat{\boldsymbol{ALE}_{t-1}}$

Assumptions

ALE depends linearly of the ALE in the previous year

Remarks: the ALE was estimated using the ordinary least squares method

Model 2 - Statistical Input

Regression Statistics	
Multiple R	0,9923
R Square	0,9847
Adjusted R Square	0,9835
Standard Error	0,0946
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7,4647	7,4647	834,5815	0,0000
Residual	13	0,1163	0,0089		
Total	14	7,5810			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	1,2571	0,5858	2,1460	0,0513
ALE(t-1)	0,9396	0,0325	28,8891	0,0000

Table B. II: Projection of ALE and the retirement age for 2016-2040 (Model 2)

Year (r)	ALE	m_r	m	NRA
2016	19,29	2,24	2	66 years and 2 months
2017	19,38	2,8	3	66 years and 3 months
2018	19,47	3,6	4	66 years and 4 months
2019	19,55	4,32	4	66 years and 4 months
2020	19,63	5,04	5	66 years and 5 months
2021	19,7	5,68	6	66 years and 6 months
2022	19,77	6,32	6	66 years and 6 months
2023	19,83	6,88	7	66 years and 7 months
2024	19,89	7,44	7	66 years and 7 months
2025	19,95	7,92	8	66 years and 8 months
2026	20	8,4	8	66 years and 8 months
2027	20,05	8,88	9	66 years and 9 months
2028	20,1	9,28	9	66 years and 9 months
2029	20,14	9,68	10	66 years and 10 months
2030	20,18	10,08	10	66 years and 10 months
2031	20,22	10,4	10	66 years and 10 months
2032	20,26	10,72	11	66 years and 11 months
2033	20,29	11,04	11	66 years and 11 months
2034	20,32	11,36	11	66 years and 11 months
2035	20,35	11,6	12	67 years
2036	20,38	11,84	12	67 years
2037	20,41	12,08	12	67 years
2038	20,43	12,32	12	67 years
2039	20,45	12,56	13	67 years and 1 months
2040	20,47	12,72	13	67 years and 1 months

Model 3: $\widehat{\boldsymbol{ALE}}_{\boldsymbol{t}} = \mathbf{0,1687}\ \boldsymbol{t} - \mathbf{320,725}$

Assumptions
ALE depends linearly on time (years)

Model 3 - Statistical Input

Regression Statistics	
Multiple R	0,9944
R Square	0,9889
Adjusted R Square	0,9881
Standard Error	0,0883
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9,6837	9,6837	1242,8548	0,0000
Residual	14	0,1091	0,0078		
Total	15	9,7928			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-320,7251	9,6101	-33,3737	0,0000
t	0,1688	0,0048	35,2541	0,0000

Table B. III: Projection of ALE and the retirement age for 2016-2040 (Model 3)

Year (r)	ALE	m_r	m	NRA
2016	19,5	2,24	2	66 years and 2 months
2017	19,67	2,8	3	66 years and 3 months
2018	19,84	5,28	5	66 years and 5 months
2019	20,01	6,64	7	66 years and 7 months
2020	20,18	8	8	66 years and 8 months
2021	20,35	9,36	9	66 years and 9 months
2022	20,52	10,72	11	66 years and 11 months
2023	20,69	12,08	12	67 years
2024	20,85	13,44	13	67 years and 1 months
2025	21,02	14,8	15	67 years and 3 months
2026	21,19	16,08	16	67 years and 4 months
2027	21,36	17,44	17	67 years and 5 months
2028	21,53	18,8	19	67 years and 7 months
2029	21,7	20,16	20	67 years and 8 months
2030	21,87	21,52	22	67 years and 10 months
2031	22,04	22,88	23	67 years and 11 months
2032	22,2	24,24	24	68 years
2033	22,37	25,6	26	68 years and 2 months
2034	22,54	26,88	27	68 years and 3 months
2035	22,71	28,24	28	68 years and 4 months
2036	22,88	29,6	30	68 years and 6 months
2037	23,05	30,96	31	68 years and 7 months
2038	23,22	32,32	32	68 years and 8 months
2039	23,39	33,68	34	68 years and 10 months
2040	23,55	35,04	35	68 years and 11 months

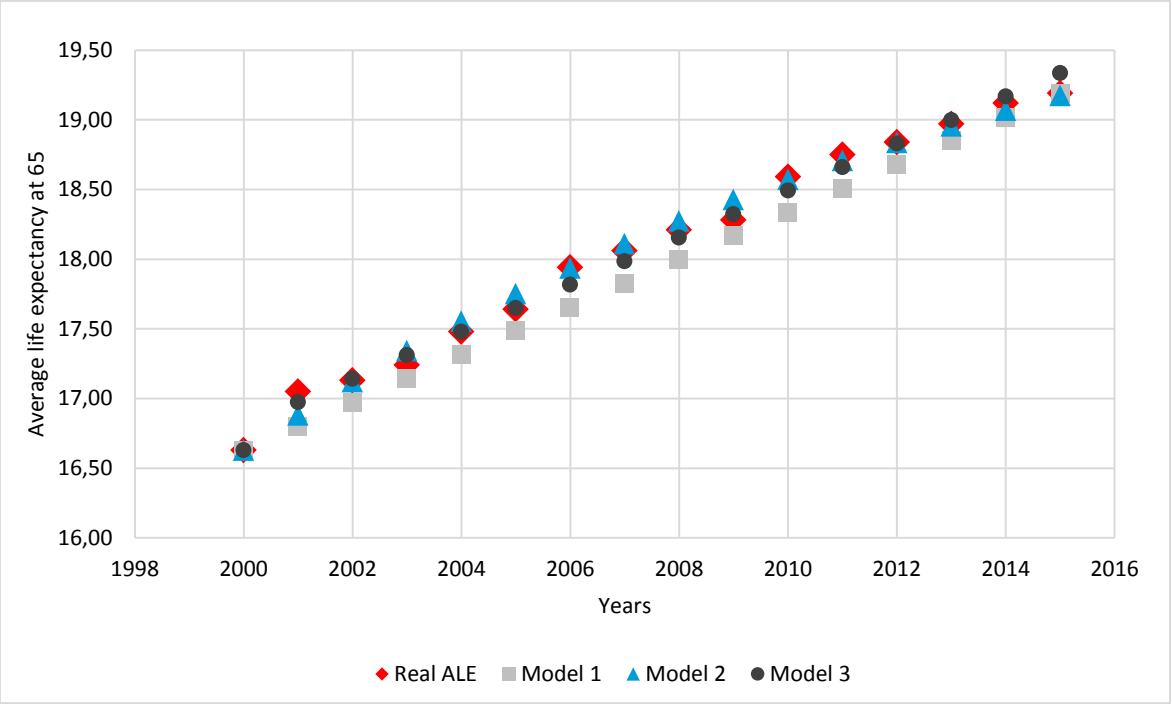

Chart 3: Comparison between the real ALE and the one estimated by the 3 models

Appendix C: Results of the SS Pension

Assumptions:	
No. of salary payments	14
Wage annual growth rate	2%
Wage annual growth rate for past salaries	2%
Revalorization index for future salaries	0,5%
IAS annual growth rate	0,25%
Age of retirement	NRA
The employees remain in the company until their retirement	

In the table above are the assumptions used to compute the value of the pensions in the tool created in VBA. Notice that the tool allows changing any of these assumptions with the exception of the last two so any other value would have been possible.

We use two populations to calculate the SS pensions – the real one and one that was intentionally modified. Below are presented the populations data and the respective results. Notice that in the results are presented for each population two tables, the first table refers to the pensions computed with the new legislation and the second table refers to the pensions computed with the previous legislation.

Population:

Table C. I: Population data

No.	Actual age	Age of entry	Current Years of service	Wage (€)
1	54	17	38	1.158,85
2	59	12	48	1.437,85
3	60	24	36	1.427,85
4	54	19	36	689,85
5	60	15	45	646,85
6	57	15	42	625,85
7	55	14	41	637,85
8	55	20	36	723,85
9	59	24	36	1.308,85

Table C. II: SS pensions computed with the DL no. 187/2007

No.	Model 1				Model 2				Model 3			
	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA
1	26/02/2025	850,49	11.906,88	65,00	26/02/2025	885,98	12.403,75	65,00	26/02/2025	845,19	11.832,64	65,00
2	02/04/2020	1.018,56	14.259,80	65,00	02/04/2020	1.035,23	14.493,21	65,00	02/04/2020	1.011,43	14.160,03	65,00
3	03/11/2019	991,74	13.884,38	65,00	03/11/2019	1.003,46	14.048,40	65,00	03/11/2019	984,74	13.786,40	65,00
4	01/02/2025	506,21	7.086,87	65,00	01/02/2025	527,33	7.382,60	65,00	01/02/2025	503,05	7.042,68	65,00
5	26/12/2019	456,42	6.389,83	65,00	26/12/2019	461,81	6.465,32	65,00	26/12/2019	453,20	6.344,74	65,00
6	20/08/2022	451,43	6.319,95	65,00	20/08/2022	463,11	6.483,57	65,00	20/08/2022	448,32	6.276,47	65,00
7	14/09/2024	467,26	6.541,70	65,00	14/09/2024	484,23	6.779,22	65,00	14/09/2024	464,10	6.497,44	65,00
8	26/01/2024	526,91	7.376,76	65,00	26/01/2024	546,04	7.644,60	65,00	26/01/2024	523,35	7.326,85	65,00
9	23/11/2020	917,08	12.839,15	65,00	23/11/2020	932,09	13.049,30	65,00	23/11/2020	910,67	12.749,32	65,00

Table C. III: SS pensions computed with the DL no. 167-E/2013

No.	Model 1				Model 2				Model 3			
	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA
1	26/02/2025	982,28	13.751,98	65,00	26/02/2025	982,28	13.751,98	65,00	26/02/2025	982,28	13.751,98	65,00
2	02/04/2020	1.128,13	15.793,88	65,00	02/04/2020	1.128,13	15.793,88	65,00	02/04/2020	1.128,13	15.793,88	65,00
3	03/06/2021	1.123,87	15.734,18	66,58	03/04/2021	1.123,87	15.734,18	66,41	03/07/2021	1.123,87	15.734,18	66,66
4	01/09/2025	584,65	8.185,06	65,58	01/02/2025	584,65	8.185,06	65,00	01/10/2025	584,65	8.185,06	65,66
5	26/12/2019	501,19	7.016,71	65,00	26/12/2019	501,19	7.016,71	65,00	26/12/2019	501,19	7.016,71	65,00
6	20/08/2022	508,55	7.119,64	65,00	20/08/2022	508,55	7.119,64	65,00	20/08/2022	508,55	7.119,64	65,00
7	14/09/2024	535,24	7.493,42	65,00	14/09/2024	535,24	7.493,42	65,00	14/09/2024	535,24	7.493,42	65,00
8	26/11/2024	602,83	8.439,60	65,83	26/05/2024	602,83	8.439,60	65,33	26/12/2024	602,83	8.439,60	65,92
9	23/07/2022	1.047,65	14.667,11	66,66	23/05/2022	1.047,65	14.667,11	66,50	23/08/2022	1.047,65	14.667,11	66,75

All values are presented in Euros

Modified population:

Table C. IV: Modified Population data

No.	Actual age	Age of entry	Current Years of service	Wage (€)
1	54	25	29	1.158,85
2	59	27	32	1.437,85
3	60	24	35	1.427,85
4	54	26	28	689,85
5	60	25	34	646,85
6	57	24	32	625,85
7	55	25	29	637,85
8	55	26	29	723,85
9	59	30	29	1.308,85

To construct the population presented in **Table C. II** only the age of entry of the real population was changed, all the other values remained the same. Below it is presented the changes done from one table to the other.

Table C. V: Changes done from the real population to the modified population

No.	Age of entry (Table C.I)	Age of entry (Table C.IV)
1	17	25
2	12	27
3	24	24
4	19	26
5	15	25
6	15	24
7	14	25
8	20	26
9	24	30

Most of the ages of entry that were altered are above 25 years since it is the youngest age from which people no longer benefit from the bonus factor. The ages chosen were chosen randomly.

Table C. VI: SS pensions computed with the DL no. 187/2007 (modified population)

No.	Model 1				Model 2				Model 3			
	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA
1	26/02/2025	839,72	11.756,11	65,00	26/02/2025	874,76	12.246,69	65,00	26/02/2025	834,49	11.682,81	65,00
2	02/04/2020	957,76	13.408,58	65,00	02/04/2020	973,43	13.628,06	65,00	02/04/2020	951,05	13.314,77	65,00
3	03/11/2019	991,74	13.884,38	65,00	03/11/2019	1.003,46	14.048,40	65,00	03/11/2019	984,74	13.786,40	65,00
4	01/02/2025	489,92	6.858,89	65,00	01/02/2025	510,36	7.145,11	65,00	01/02/2025	486,87	6.816,12	65,00
5	26/12/2019	449,02	6.286,27	65,00	26/12/2019	454,32	6.360,53	65,00	26/12/2019	445,85	6.241,91	65,00
6	20/08/2022	447,26	6.261,66	65,00	20/08/2022	458,84	6.423,77	65,00	20/08/2022	444,18	6.218,59	65,00
7	14/09/2024	456,00	6.384,00	65,00	14/09/2024	472,56	6.615,79	65,00	14/09/2024	452,91	6.340,80	65,00
8	26/01/2024	499,51	6.993,12	65,00	26/01/2024	517,64	7.247,03	65,00	26/01/2024	496,13	6.945,80	65,00
9	23/11/2020	807,59	11.306,26	65,00	23/11/2020	820,81	11.491,32	65,00	23/11/2020	801,94	11.227,15	65,00

Table C. VII: SS pensions computed with the DL no. 167-E/2013 (modified population)

No.	Model 1				Model 2				Model 3			
	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA	Retirement date	Monthly SS pension	Annual SS pension	NRA
1	26/05/2027	1.003,86	14.053,99	67,24	26/10/2026	985,35	13.794,95	66,66	26/06/2027	1.003,86	14.053,99	67,33
2	02/12/2021	1.101,97	15.427,53	66,67	02/10/2021	1.101,97	15.427,53	66,50	02/01/2022	1.120,79	15.691,06	66,75
3	03/06/2021	1.123,87	15.734,18	66,58	03/04/2021	1.123,87	15.734,18	66,41	03/07/2021	1.123,87	15.734,18	66,66
4	01/05/2027	598,38	8.377,37	67,24	01/10/2026	587,98	8.231,72	66,66	01/06/2027	598,38	8.377,37	67,33
5	26/07/2021	513,60	7.190,47	66,58	26/05/2021	513,60	7.190,47	66,41	26/08/2021	513,60	7.190,47	66,67
6	20/07/2024	521,15	7.296,10	66,92	20/03/2024	521,15	7.296,10	66,58	20/08/2024	521,15	7.296,10	67,00
7	14/11/2026	546,00	7.644,01	67,17	14/05/2026	546,63	7.652,81	66,66	14/12/2026	546,00	7.644,01	67,25
8	26/03/2026	617,79	8.649,03	67,16	26/09/2025	607,16	8.500,31	66,67	26/04/2026	617,79	8.649,03	67,25
9	23/07/2022	969,21	13.568,92	66,66	23/05/2022	969,21	13.568,92	66,50	23/08/2022	969,21	13.568,92	66,75

All values are presented in Euros

Appendix D: Impacts of the reforms

The impact of the NRA

Table D. I: Impact of NRA (Scenario 1)

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	850,49	856,45	0,7%	885,98	890,04	0,5%	845,19	850,84	0,7%
2	1.018,56	1.017,04	-0,1%	1.035,23	1.039,14	0,4%	1.011,43	1.018,73	0,7%
3	991,74	998,19	0,7%	1.003,46	1.019,89	1,6%	984,74	990,86	0,6%
4	506,21	509,88	0,7%	527,33	530,48	0,6%	503,05	506,53	0,7%
5	456,42	460,29	0,8%	461,81	470,30	1,8%	453,20	456,91	0,8%
6	451,43	455,14	0,8%	463,11	472,45	2,0%	448,32	451,87	0,8%
7	467,26	470,80	0,8%	484,23	494,79	2,2%	464,10	467,69	0,8%
8	526,91	530,04	0,6%	546,04	548,52	0,5%	523,35	526,54	0,6%
9	917,08	922,30	0,6%	932,09	946,97	1,6%	910,67	915,57	0,5%

Caption: Δ is the percentage of increase/decrease occurred from *Before* to *After*.

Remark: Values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 0,5%.

Table D. II: Impact of NRA (Scenario 2)

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	850,49	819,44	-3,7%	885,98	861,36	-2,8%	845,19	812,70	-3,8%
2	1.018,56	984,16	-3,4%	1.035,23	1.008,87	-2,5%	1.011,43	984,16	-2,7%
3	991,74	967,54	-2,4%	1.003,46	991,83	-1,2%	984,74	958,88	-2,6%
4	506,21	487,84	-3,6%	527,33	513,39	-2,6%	503,05	483,83	-3,8%
5	456,42	446,16	-2,2%	461,81	457,36	-1,0%	453,20	442,14	-2,4%
6	451,43	438,27	-2,9%	463,11	457,94	-1,1%	448,32	434,39	-3,1%
7	467,26	451,13	-3,5%	484,23	478,85	-1,1%	464,10	447,43	-3,6%
8	526,91	507,93	-3,6%	546,04	530,79	-2,8%	523,35	503,73	-3,7%
9	917,08	892,59	-2,7%	932,09	919,48	-1,4%	910,67	884,59	-2,9%

Remark: Values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 2,5%.

Table D. III: Impact of NRA (Scenario 3)

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	850,49	793,17	-6,7%	885,98	840,82	-5,1%	845,19	785,69	-7,0%
2	1.018,56	960,61	-5,7%	1.035,23	987,12	-4,6%	1.011,43	959,42	-5,1%
3	991,74	945,55	-4,7%	1.003,46	971,65	-3,2%	984,74	935,97	-5,0%
4	506,21	472,20	-6,7%	527,33	501,15	-5,0%	503,05	467,74	-7,0%
5	456,42	436,02	-4,5%	461,81	448,05	-3,0%	453,20	431,56	-4,8%
6	451,43	426,24	-5,6%	463,11	447,54	-3,4%	448,32	421,94	-5,9%
7	467,26	437,16	-6,4%	484,23	467,43	-3,5%	464,10	433,06	-6,7%
8	526,91	492,22	-6,6%	546,04	518,09	-5,1%	523,35	487,55	-6,8%
9	917,08	871,30	-5,0%	932,09	899,73	-3,5%	910,67	862,43	-5,3%

Remark: Values in *After* are referred to the same time reference than the ones in *Before* using an annual discount rate of 4%.

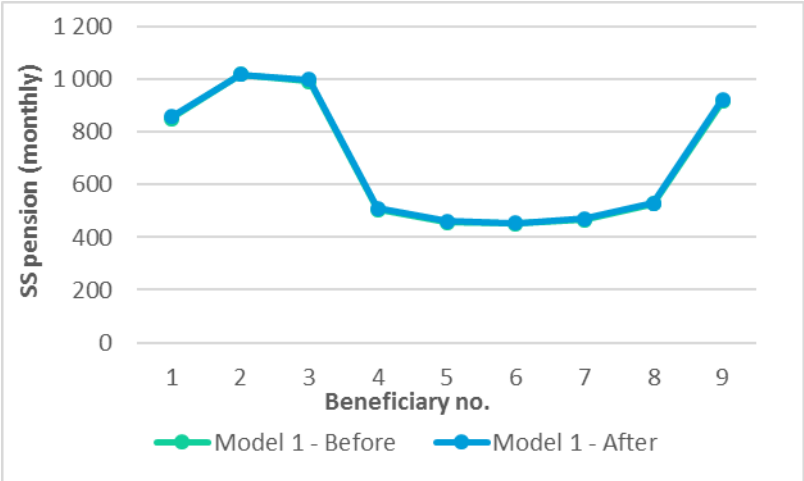

Chart 4: Impact of the NRA (Scenario 1)

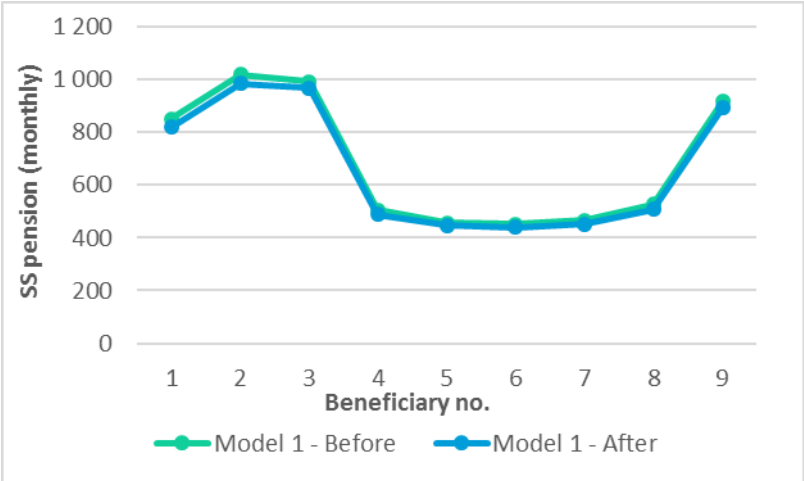

Chart 5: Impact of the NRA (Scenario 2)

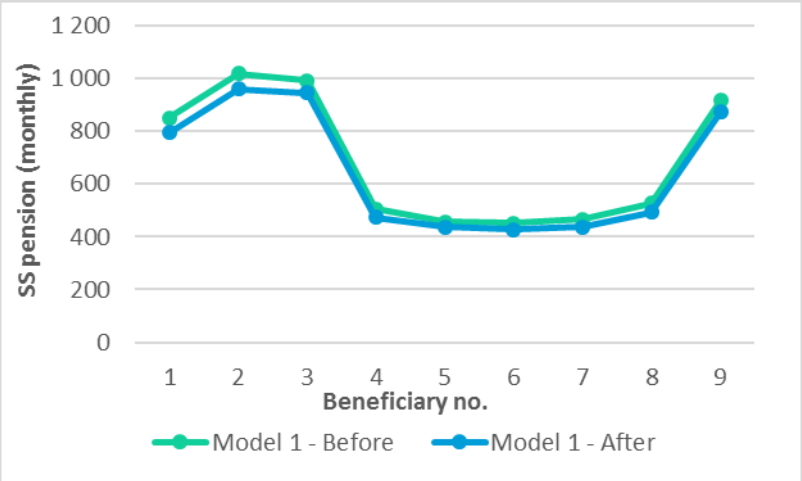

Chart 6: Impact of the NRA (Scenario 3)

The impact of the SF

Table D. IV: Impact of the SF

No.	Model 1			Model 2			Model 3		
	Before	After	Δ	Before	After	Δ	Before	After	Δ
1	850,49	982,28	15,5%	885,98	982,28	10,9%	845,19	982,28	16,2%
2	1.018,56	1.128,13	10,8%	1.035,23	1.128,13	9,0%	1.011,43	1.128,13	11,5%
3	991,74	1.089,04	9,8%	1.003,46	1.089,04	8,5%	984,74	1.089,04	10,6%
4	506,21	584,65	15,5%	527,33	584,65	10,9%	503,05	584,65	16,2%
5	456,42	501,19	9,8%	461,81	501,19	8,5%	453,20	501,19	10,6%
6	451,43	508,55	12,7%	463,11	508,55	9,8%	448,32	508,55	13,4%
7	467,26	535,24	14,5%	484,23	535,24	10,5%	464,10	535,24	15,3%
8	526,91	603,57	14,5%	546,04	603,57	10,5%	523,35	603,57	15,3%
9	917,08	1.015,74	10,8%	932,09	1.015,74	9,0%	910,67	1.015,74	11,5%